Changes in Neural Processing After Multimodal Speech-Gesture Training in Patients With Schizophrenia

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Background

Dysfunctional social communication in patients with schizophrenia spectrum disorder (SSD):

- Interpreting abstract (abs) vs. concrete (con) speech
- Integrating speech and gesture (SG)

➔ aberrant activation in left inferior frontal gyrus (IFG) in superior/middle temporal regions (STS, MTG)[1]

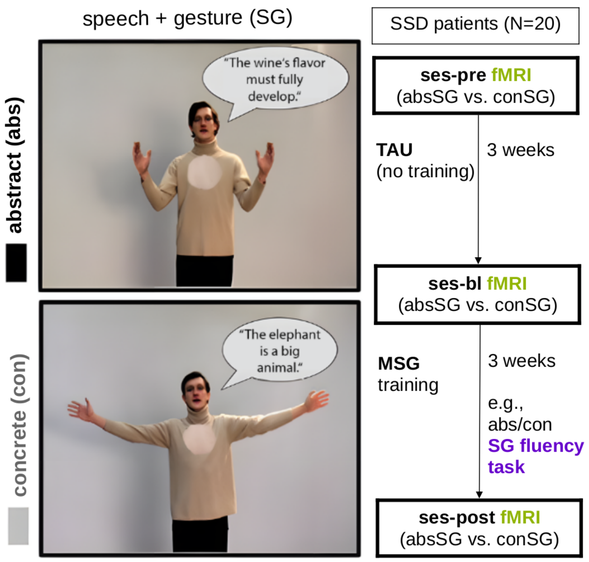
Objectives:
Improving integration of gesture in abstract speech context through a novel multimodal speech-gesture training (MSG):
1) In behavioral performance
2) In neural processing
3) Explore associations of behavioral + neural changes

Methods

FMRI data acquisition: 3 Tesla scanner

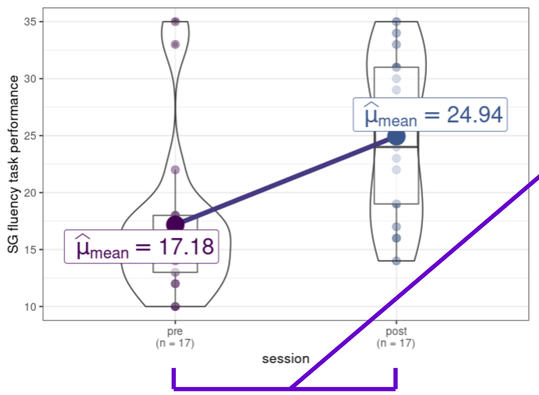
Analysis: fMRIPrep[2] + SPM12; ggstatsplot[3] (RStudio)

Contrast of interest: sessions X abstractness in SG

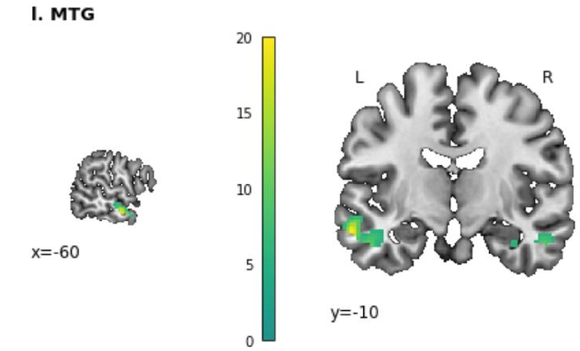


Results

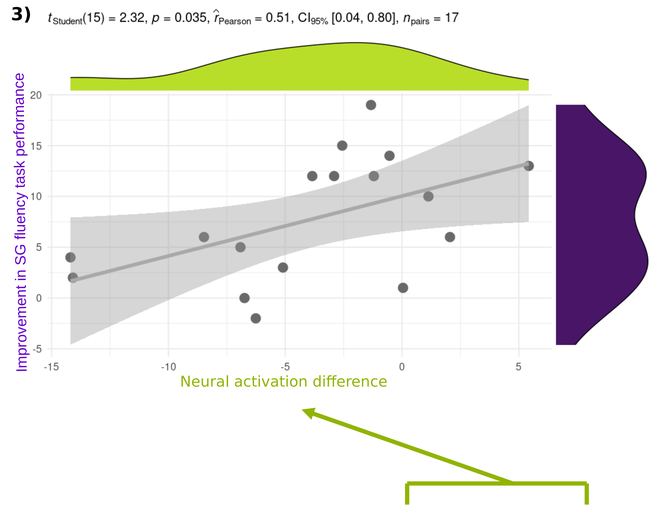
1) $t_{Student}(16) = -5.28$, $p = 7.53e\text{-}05$, $\hat{g}_{Hedges} = -1.22$, $CI_{95\%}$ [-1.88, -0.61], $n_{pairs} = 17$

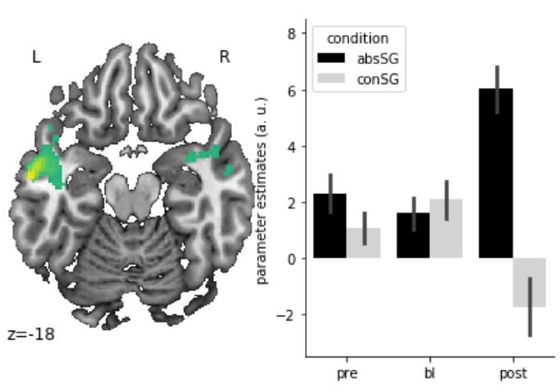


2)



3) $t_{Student}(15) = 2.32$, $p = 0.035$, $\hat{r}_{Pearson} = 0.51$, $CI_{95\%}$ [0.04, 0.80], $n_{pairs} = 17$





1. MSG training session (first versus last training session) comparison of the patients' performance in speech-gesture (SG) fluency training task.
The values represent the sum of correctly produced speech-gesture pairs for each of the three semantic categories per training session. Patients were asked to produce as many speech-gesture pairs as possible in one minute per semantic field.

2. Neural activation sessions X abstractness contrast.
Activation clusters were thresholded at p < 0.01, with a minimum cluster size of 221 voxels, cluster level corrected at p > 0.05. Error bars indicate the standard error of the mean (s.e.m.). Crosshair point at the left MTG [x = -60, y = -10, z = -18]
MTG = middle temporal gyrus; L = left; R = right.

3. Correlation of the patients' improvement during training (last - first training session) in the SG fluency task and the difference (ses-post - ses-pre) in neural activation (sessions X abstractness contrast) in the conSG condition.

Discussion

1) improvement in behavioral performance (e.g., SG fluency training task):
possible modification of dysfunctional social-communicative skills in SSD

2) sessions X abstractness interaction:
➔ possible training-specific effects

3) **Correlation of 1) and 2)**:
➔ Possible association of MSG-related modification in neural activation

Self-report measures and ratings from relatives confirm MSG-related changes.

Outlook

Investigation of the underlying mechanisms of changes in neural processing after MSG training:

- analyses of audio-visual concept learning in the Audio-Video Language Network (AVLnet)[4], a self-supervised network that learns a shared audio-visual embedding space directly from raw video inputs.
- comparing AVLnet's learned representations with the MSG training induced changes

➔ implications for future therapy approaches?

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Design and Methods are in detail described here. Please find our public project incl. material and first data also on OSF.

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